Spring 2011

CEG 416-01: Matrix Computations

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CEG/MTH 416/616 Matrix Computations

Section 1 – Spring 2011 M, W, & F 12:15-1:05 p.m., Russ Center Room 150
Last Updated: March 27, 2011

Description: This course is a survey of numerical methods in linear algebra for application to problems in engineering and the sciences. Emphasis is on using modern software tools on high performance computing systems. This course covers the mathematics of linear equations, eigenvalue problems, singular value decomposition, and least squares. Material covered will be relevant to applications areas such as structural analysis, heat transfer, neural networks, mechanical vibrations, and image processing in biomedical engineering. A familiarity with MATLAB is useful, and the ability to program in languages such as C/C++ or Fortran is very important. A basic knowledge of matrix algebra is required. Four credit hours.

Prerequisites: MTH 253 or 355 (matrix or linear algebra); and CS 142 or 241 (intermediate programming).

Instructor: Dr. Ronald F. Taylor, RC 340, 775-5122, ronald.taylor@wright.edu , Tuesday 2-4 p.m.; Wednesday and Friday 9-11 a.m.; other times by appointment.

Required Textbook:

Numerical Linear Algebra and Applications, 2nd Edition, Biswa Datta, SIAM, 2010, ISBN 978-0-898716-85-6.

Suggested Resources:

Matrix Operations, Richard Bronson, Schaum's Outline, McGraw-Hill, 1998, ISBN 0-07-007978-1. (E-book Dunbar Library)

Course Home Page and Pilot: http://www.cs.wright.edu/people/faculty/rtaylor/ceg416sp11 available by the start of second week of class. We may be using Pilot for posting of grades and submittal of some assignments or portions of assignments. Students should familiarize themselves with accessing Pilot . Students are also responsible for accessing the Course Home Page or Pilot for printing copies of resource materials as needed. Some handouts may be given in class.

Programming: MATLAB Student Edition http://www.mathworks.com/academia/student_version/ from MathWorks (about $100). Wright State University's College of Engineering and Computer Science provides a special licensing program for the MathWorks MATLAB software. More information at http://www.wright.edu/software/mathworks/ . Students may also use Octave which is free http://www.gnu.org/software/octave/download.html . When we refer to "MATLAB" students may also substitute "Octave". If you decide to use Octave instead of MATLAB, please inform the instructor. Writing and using numerical programs is an important part of this course. Programming assignments mostly will require MATLAB which is available on a number of Wright State systems. It is expected that students will spend a minimum of 2 hours per week working in a computer lab or equivalent environment enhancing their programming skills and completing programming assignments for this course. We may also use the C programming language for some class demonstrations. Some assignments may involve using or adapting some given C programs.

Computers and Computing Accounts: You must be able to access the Web and have a WSU Student Login to Wings, e-mail, and Pilot. Check your WSU e-mail on a regular basis for any course announcements from the instructor. Get familiar with the use of the PCs in Russ Center 152C to access MATLAB if you do not have it on your own PC. Needed computing topics be covered in class and handouts or web citations given as appropriate. Check the University computing information at http://www.wright.edu/cats/studentzone .

Grading Policy: Mid-term exam with content quizzes – 35% . One comprehensive final – 40%. Homework/Project assignments with homework quizzes – 25%. Content quizzes may be in class or take-home: points included with mid-term score. Students registered at the graduate level (i.e. CEG 616 or MTH 616) will be required to complete extra problems, programs and/or special projects as part of the Homework/Project component of this course. Homework/Projects will be spot checked for organization, completeness, and accuracy. Homework quizzes may be given on the day of Homework/Project submittal. Students are expected to be able to answer questions regarding these submittals. Students will be allowed to use only their own Homework/Project submittal and a calculator during the homework quizzes. Points for Homework/Projects and homework quizzes will be given when each assignment is made. In general, about one week will be given to prepare larger assignments. Smaller homework problems/investigations may be due the next class period. Follow the "Homework Standards" posted on the course website.

Course Grade Based on Course Average:

A: 100-90, **B**: less than 90-80, **C:** less than 80-70, **D:** less than 70-60, **F:** less than 60-0.

Class Policies: No late or early exams unless verifiable emergency. No make-up content or homework quizzes: content quizzes may be unannounced. Attendance at lecture is not a component of your grade. However, students are expected to attend all lectures and to participate in class discussion. Attendance may be taken in the course to better get to know students. In cases of infrequent attendance, lower homework and exam grades will inevitably result since a significant portion of lecture material is not covered in the text. All Homework/Project assignments are due in class on the date and time specified. Grades on late assignments will be reduced by 10%. Submittals more than one day late will not be graded - "zero" grade assigned. . Exceptions to the above policies may be made unusual circumstances when documentation is provided in writing -- otherwise expect strict enforcement of the policies. All work submitted must be your own unless group assignments are explicitly made by the instructor; sharing of program code or copying problem solutions/codes from any source will result in at least a homework grade of "zero" for all involved and possibly a grade of "F" for the course. University procedures for plagiarism will be strictly followed. Sharing ideas and general mathematical and computer skills with others outside of class is encouraged. Students are expected to read, understand and follow the University Academic Integrity Policy at: http:/www.wright.edu/students/judicial/integrity.html. .

Supplemental Class Information and Homework Standards: A document: "Supplemental Information" is given on the course website which clarifies and details how the above class and grading policies are to be implemented. Also carefully study and follow the "Homework Standards" document on the course website. Students are responsible for understanding these documents referring to them during the quarter as needed. Please ask for clarification if you have questions on either of these two important documents.

Schedule: Readings - Numerical Linear Algebra (**2nd edition - Required Textbook**). Reference - Notes: online or handout documents specified in lecture. Topics and schedule may vary. **Exams dates and times** are firm.

Week	Topic/Tests etc.	Readings/Reference
1	Introduction to Matrix Computations; Matrix Operations and Applications; MATLAB Fundamentals	Chapter 1 and Notes
2	Matrix Concepts: Vectors, Orthongonality, Special Matrices, Norms, Introduction to the Singular Value Decomposition and Eigenvalue Problems	Chapters 2
3	Floating Point Numbers and Computational Errors Introduction to Stability & Condition	Chapters 3 and 4 (or equivalent Notes)
4	Solving Linear Equations by Gaussian Elimination & Factorization	Chapter 5 and Notes
5	Solving Linear Equations by Iteration and Applications **(Mid-Term Exam – Friday April 29th)**	Chapter 12 and Notes
6	QR Factorization and the Singular Value Decomposition	Chapter 7 and Notes
7	Least Squares Solutions of Linear Equations and Applications	Chapter 8 and Notes
8	Matrix Eigenvalue Problems and Applications	Chapters 9, 10 and Notes
9	Generalized Eigenvalue Problem and Applications	Chapter 11 and Notes
10	Selected Special Topics & Applications (as time permits): Image Processing, Data Mining & Parallel Computations	Notes
Finals	**Comprehensive Final – Wednesday June 8th 1:00 – 3:00 p.m.**	